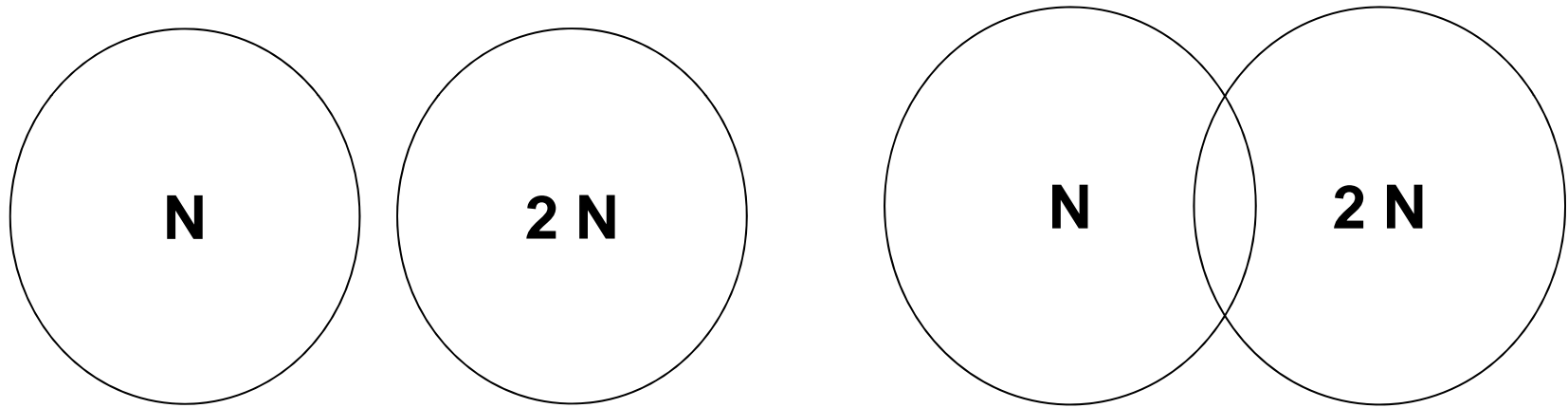




Competencia gametofítica



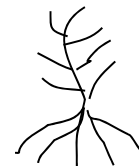
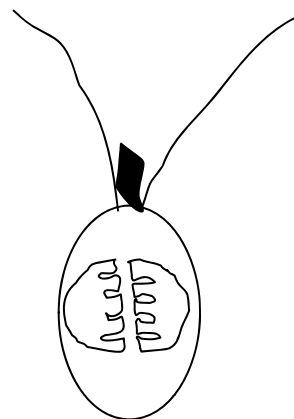
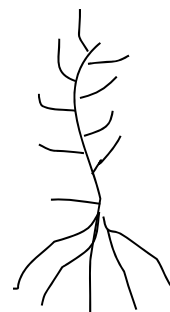
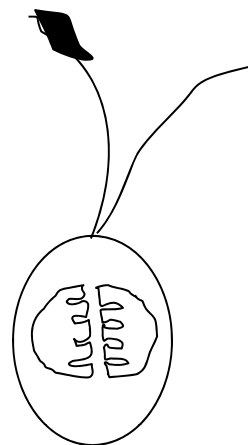
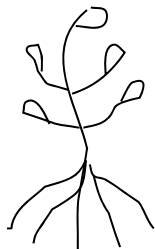
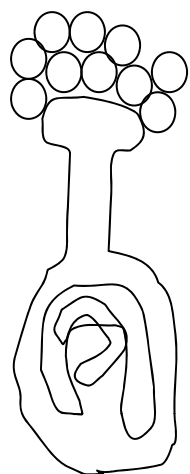
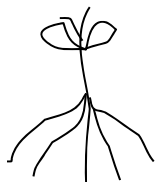
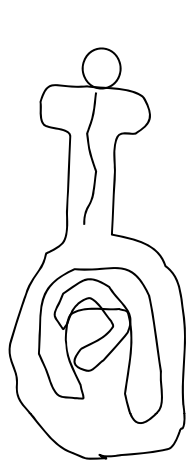


TABLE 1. A. Seed production by the six ovule positions on each of the three genets of *Phaseolus coccineus* that were grown in an experimental garden in 1987 (ovule position 1 = stylar end of the fruit; ovule position 6 = peduncular end). 102 total fruits. B. Multiple contingency table analysis (CATMOD Procedure, SAS Inc., 1985)

A.

Ovule position	Genet						All genets combined	
	A		B		C			
	Seed (%)	No seed	Seed (%)	No seed	Seed (%)	No seed	Seed (%)	No seed
1	22 (57.9)	16	30 (68.2)	14	11 (55.0)	9	63 (61.8)	39
2	31 (81.6)	7	31 (71.1)	13	12 (60.0)	8	74 (72.5)	28
3	21 (55.3)	17	27 (61.4)	17	12 (60.0)	8	61 (59.8)	41
4	20 (52.6)	18	22 (50.0)	22	7 (35.0)	13	49 (48.0)	53
5	18 (47.4)	20	20 (45.5)	24	9 (45.0)	11	47 (46.1)	55
6	12 (31.6)	26	12 (27.3)	32	7 (35.0)	13	31 (30.4)	71

B.

Source of variance	df	Chi-square	Probability
Intercept	1	514.7	0.0001
Genet	2	1.4	0.5094
Ovule position	5	45.8	0.0001
Genet × ovule position	10	9.2	0.5120

Rocha, O.J. y A.G. Stephenson. 1990. Effect of ovule position on seed production, seed weight, and progeny performance in *Phaseolus coccineus* L. (Leguminosae). Amer. J. Bot 77: 1320-29.

TABLE 8. Results of fixed effects model analysis of variance (GLM, SAS Inc., 1985) and multivariate analysis of variance (MANOVA, SAS Inc., 1985) for the greenhouse performance of a sample of the progeny produced by the three genets during the 1987 field study. Additional sources of variance in the model include the three-way interaction of genet by seed number per fruit by ovule position and the intensity of the supplemental high pressure sodium lights immediately above the plants on the greenhouse bench as a covariate

Source of variance	Time to emergence	Time to first leaf	Leaf area at 14 days	Increase in leaf area from day 14 to day 28	Dry weight at 28 days	Overall effect (MANOVA)
Seed weight	—	***	****	—	***	****
Genet	***	****	****	****	****	****
Clone (genet)	—	—	—	—	—	—
Seed number per fruit	*	—	—	—	—	—
Seed number × genet	—	—	—	—	—	—
Ovule position	—	—	**	—	—	—
Ovule position × genet	—	—	—	—	*	—
Ovule position × seed number	**	—	—	—	—	*

TABLE 9. Results of fixed effects model analysis of variance (GLM, SAS Inc., 1985) and multivariate analysis of variance (MANOVA, SAS Inc., 1985) for the field performance of a sample of the progeny produced by the six genets during the 1988 field study. Additional sources of variance in the model include the three-way interaction of genet by seed number per fruit by ovule position and an indicator variable denoting whether or not the seedlings were damaged by an herbivore (*Diabrotica* sp.) during the first week after transplanting

Source of variance	Time to first flower	Total flower production	Total fruit production	Total seed production	Overall effect (MANOVA)
Seed weight	—	—	—	—	—
Genet	*	—	—	**	****
Seed number per fruit	—	—	—	—	—
Seed number × genet	—	*	—	*	—
Ovule position	****	—	***	**	***
Ovule position × genet	*	—	—	—	—
Ovule position × seed number	***	*	*	**	**

* = 0.10 > P > 0.05; ** P < 0.05; *** P < 0.01; **** P < 0.0001.

Table 3A, B. Number of fertilized ovules, mature seeds, and fertilized ovules that failed to mature seeds in each of the six ovule positions. **A** In flowers that had the distal end of the style excised 2.5 h after pollination; **B** In flowers that had the distal end of the style excised 3.5 h after pollination

A. Distal end of style excised 2.5 h after pollination

	Number of fruits examined	Ovule position						Total
		1	2	3	4	5	6	
Ovules fertilized	27	16 (59.3)	18 (66.7)	8 (29.6)	0 (0)	0 (0)	0 (0)	42 (25.9)
Seeds matured	27	13 (48.1)	15 (55.5)	8 (29.6)	0 (0)	0 (0)	0 (0)	36 (22.2)
Fertilized ovules that failed to mature	27	3	3	0	0	0	0	6

* Numbers in parentheses indicate the percentage of the ovules in each ovule position within the fruit that were fertilized or produced mature seeds

B. Distal end of style excised 3.5 h after pollination

Treatment	Number of fruits examined	Ovule position ^a						Total
		1	2	3	4	5	6	
Ovules fertilized	22	21 (95.5)	21 (95.5)	19 (86.4)	17 (77.3)	13 (59.1)	6 (31.9)	98 (74.2)
Seeds matured	22	14 (63.6)	18 (81.8)	14 (63.6)	12 (54.5)	10 (45.4)	6 (27.2)	74 (56.1)
Fertilized ovules that failed to mature	22	6	3	5	5	3	1	24

* Numbers in parentheses indicate the percentage of the ovules in each ovule position within the fruit that were fertilized or matured seeds

Rocha, O.J. y A.G. Stephenson. 1991. Orden of fertilization within the ovary in *Phaseolus coccineus* L. (Leguminosae). Sex Plant Reprod 4: 126-131.

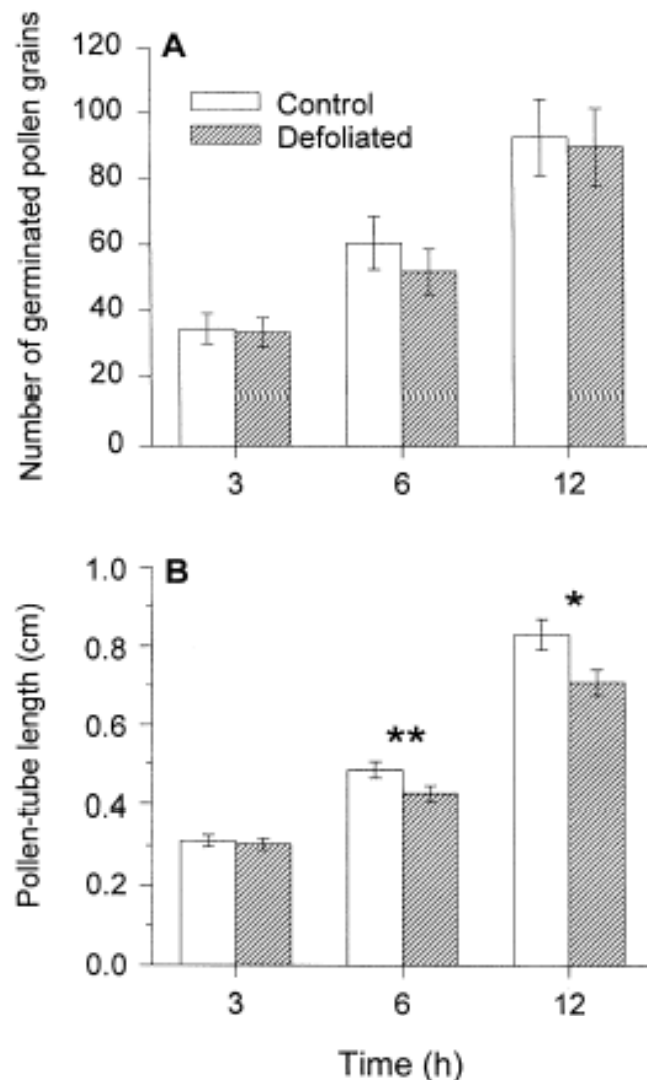


FIG. 1. Least-squares means \pm 1 SE for (A) the number of germinated pollen grains after statistically controlling for the total number of grains deposited on the stigma, and (B) tube length after controlling for the number of germinated pollen grains in recipient styles fixed at 3, 6, and 12 h after pollination, and pollinated with pollen produced by either control or defoliated shoots (laboratory experiment). Asterisks show level of statistical significance (* P < 0.05, ** P < 0.01) for the treatment effect of mixed-model ANCOVAs conducted for each time separately. See Table 2 for overall treatment effects.

Aizen, M.A. y E. Raffaele. 1998.
Flowering shoot defoliation affects pollen
grain size and postpollination pollen
performance in Alstroemeria aurea.
Ecology 79: 2133-2142.

TABLE 3. Least-squares means, standard errors, and analysis of covariance results for the effect of defoliation treatment on the number of germinated pollen grains and the number of pollen tubes reaching the base of the style (field experiment).

	Number of germinated pollen grains†			Number of pollen tubes†		
	Mean	- 1 SE	+1 SE	Mean	- 1 SE	+1 SE
Control	56.3	3.7	4.0	13.8	0.61	0.63
Defoliated	49.2	3.3	3.4	10.7	0.48	0.51

Source	Number of germinated pollen grains			Number of pollen tubes		
	df	MS	F	df	MS	F
Treatment	1	0.0841	1.96	1	0.2418	14.76***
Block	50	0.1206	2.82***	50	0.1325	8.09****
Total grains	1	0.6756	15.79***
Germinated grains	1	1.0610	64.75****
Error	49	0.0430		49	0.0164	

Notes: Donor pair \times recipient combination was included as a blocking factor. The total number of pollen grains deposited on the stigma was used as a covariate for the number of germinated pollen grains, and this last variable was used as a covariate for the number of pollen tubes. All dependent variables and covariates were log transformed. Mean square estimates are from Type III sums of squares (SAS 1988).

† Back-transformed means of a log-transformed variable, hence the asymmetric standard errors.

*** $p < 0.001$, **** $p < 0.0001$.

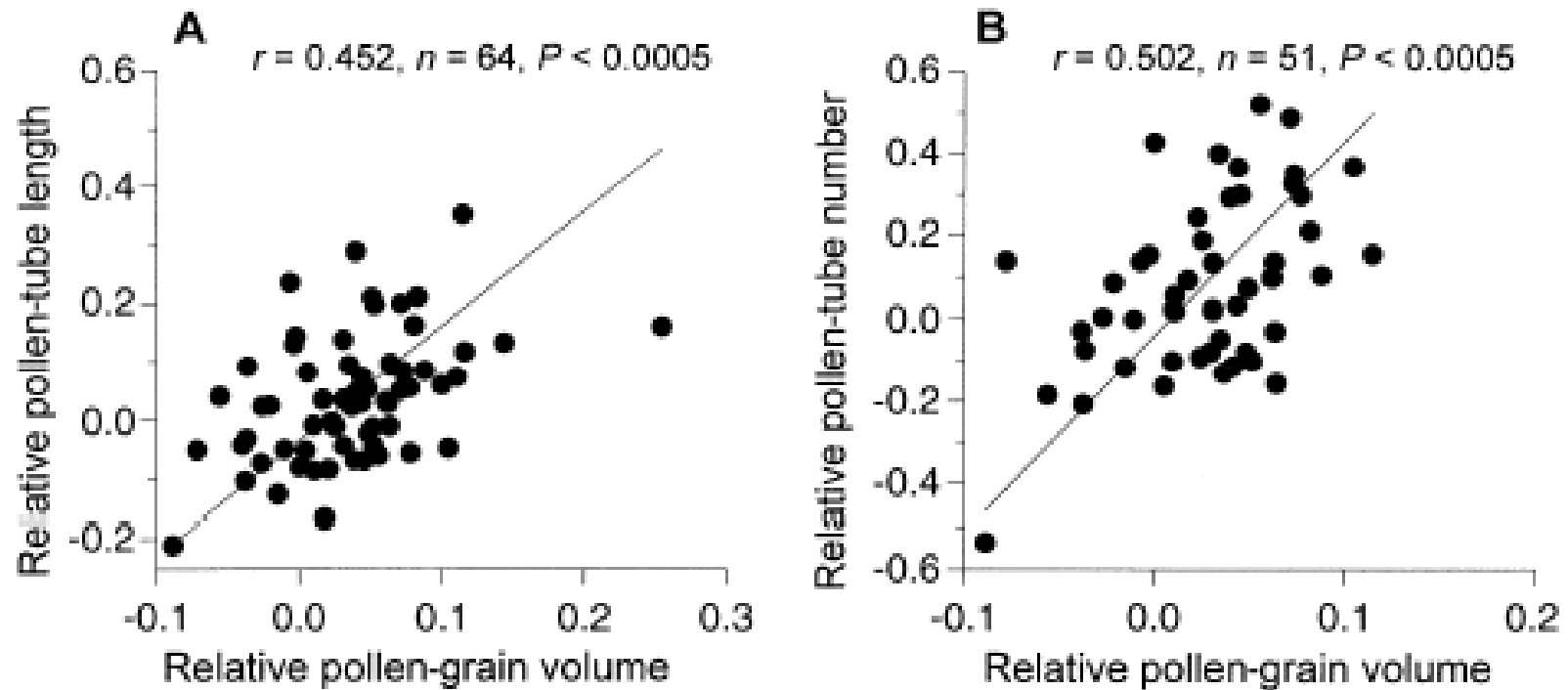


FIG. 2. Scatter plots of (A) relative pollen-tube length vs. relative pollen-grain volume (laboratory experiment), and (B) relative number of pollen tubes reaching the base of the stigma (after correcting for variation introduced by the number of germinated pollen grains) vs. relative pollen-grain volume (field experiment). Relative values were calculated as the difference in the log-transformed variable corresponding to the pollen produced by a given control and paired defoliated shoot (see *Data analysis*). Lines indicate reduced major axis regression equations: (A) $Y = -0.035 + 1.966X$ and (B) $Y = -0.044 + 4.747X$.

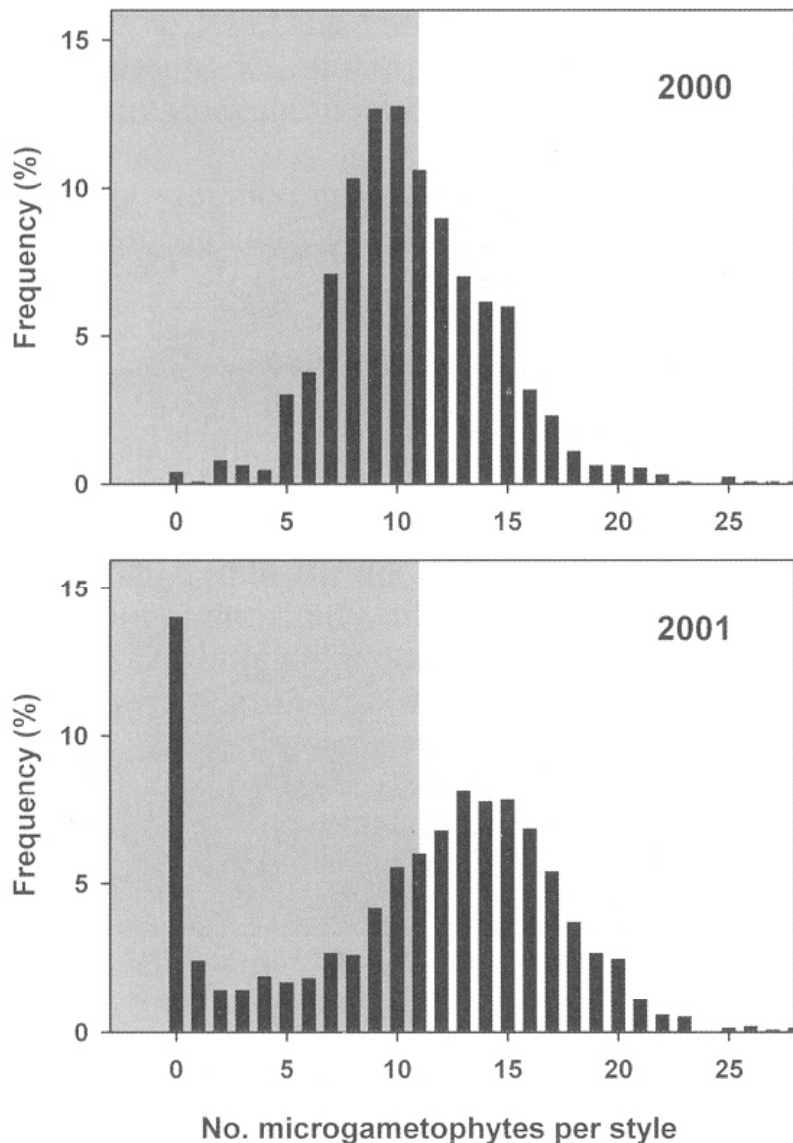


Fig. 2. Frequency distributions of the number of microgametophytes per style in the Cazorla region in 2000 and 2001, all populations combined. See Table 2 for sample sizes and summary statistics. In each graph, the shaded portion denotes the area of the distribution with number of pollen tubes inferior to the mean number of ovules per carpel (11).

Herrera, C.M. 2002. Censuing natural microgametophyte populations: variable spatial mosaics and extreme fine-graininess in winter-flowering *Helleborus foetidus* (Ranunculaceae). *Am. J. Bot.* 89: 1570-78.

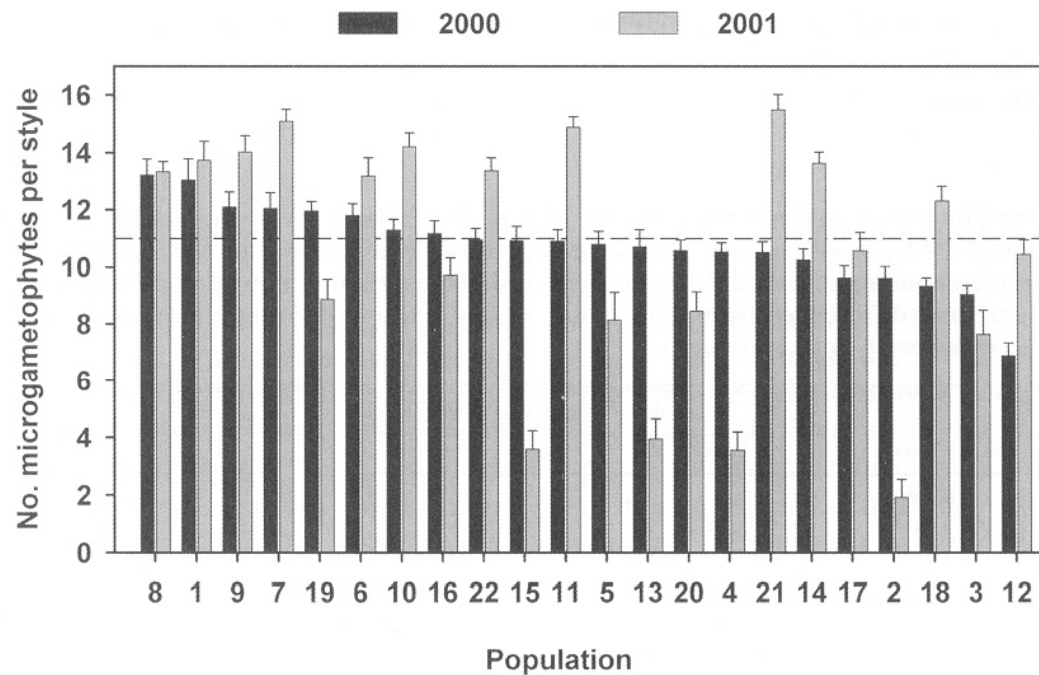


Fig. 3. Variation among Cazorla populations in mean number of microgametophytes per style in 2000 (filled bars) and 2001 (shaded bars). From left to right, populations are arranged in decreasing order of mean values for 2000. Vertical segments extend over 1 SE. The horizontal dashed line is shown as a reference for the mean number of ovules per carpel ($y = 11$).

TABLE 3. Partition of variance in the number of pollen tubes per style in some of the data sets examined in this study. Entries in the table represent the variance component accounted for by a given source of variation (row) in a given data set (column), with the standard error shown in parentheses. Dashes denote variance components that either are not applicable or could not be computed for that particular data set. Variance components were tested for significant differences from zero using an approximate asymptotic test (for details, see Materials and Methods: Statistical analyses; * $P < 0.05$ or better; ^{ns} not significant).

Source	All regions 2000	Data subsets with within-flower sampling		Cazorla ^c	
		Cazorla 2000 ^a	Caurel 2000 ^b	2000	2001
Region	1.35 (1.64) ^{ns}	—	—	—	—
Population	1.13 (0.47)*	0.03 (0.18) ^{ns}	0.52 (0.57) ^{ns}	1.24 (0.59)*	16.67 (5.46)*
Plant	4.12 (0.48)*	0.76 (0.42)*	0.75 (0.45)*	5.31 (0.66)*	6.80 (0.98)*
Within-plant (total)	6.71 (0.25)*	9.10 (0.55)*	4.51 (0.36)*	7.07 (0.31)*	18.71 (0.73)*
Flower	—	3.60 (0.63)*	2.02 (0.51)*	—	—
Carpel	—	5.50 (0.44)*	2.49 (0.28)*	—	—

^a Three populations.

^b Four populations.

^c Twenty-two populations.

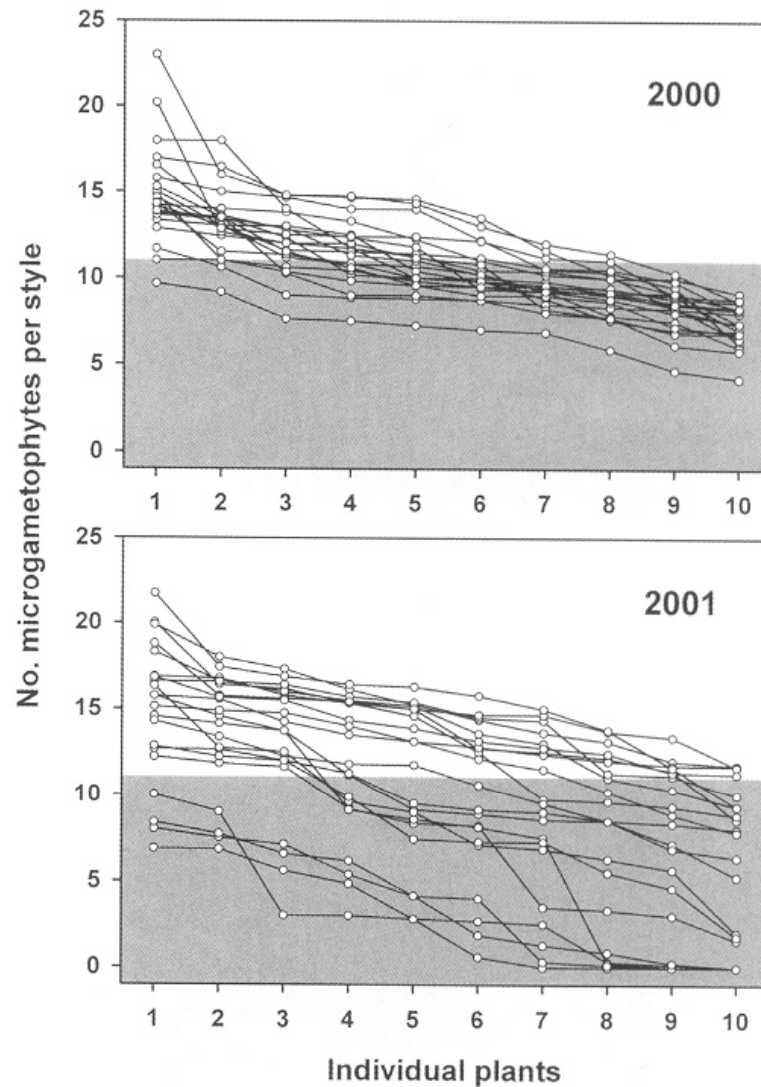
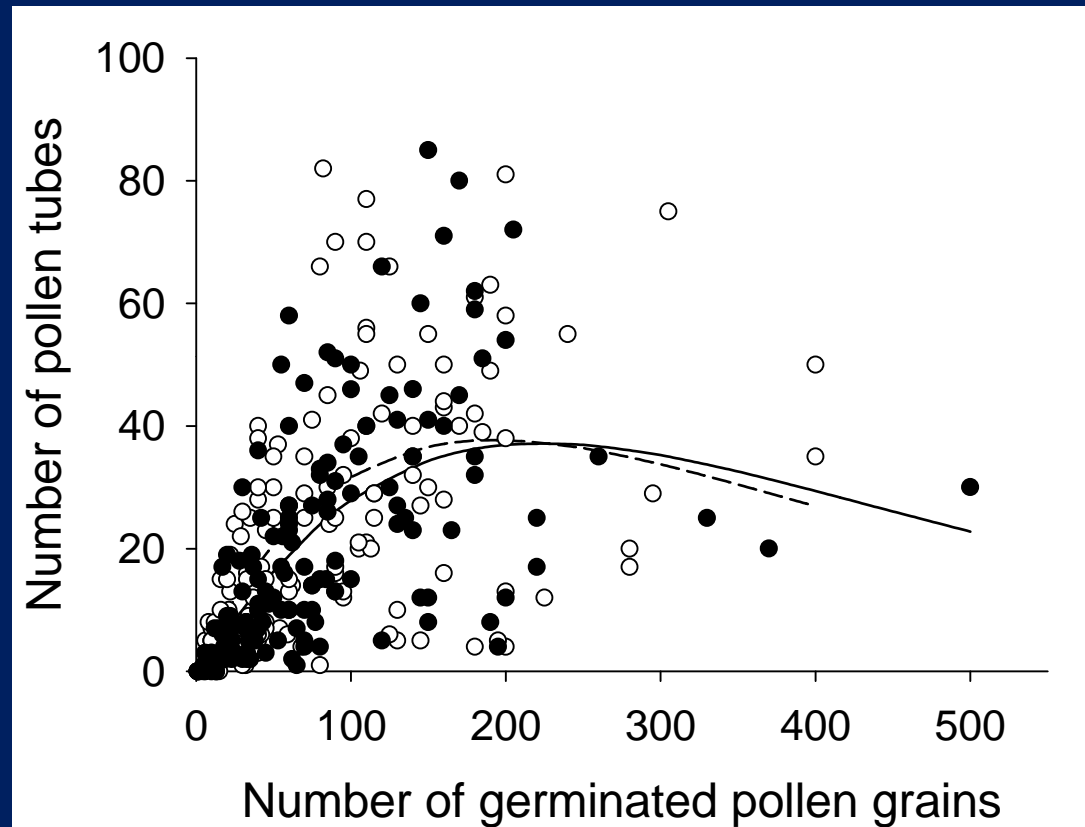


Fig. 5. Within-population, among-individual variation in mean number of pollen tubes per style in the 22 Cazorla populations studied in 2000 and 2001. Each symbol corresponds to the mean for an individual plant, and means from the same population are connected by a line. In each population, plants have been ranked on the horizontal axis in decreasing order of mean number of pollen tubes. The shaded portion of each graph denotes the area with number of pollen tubes less than the mean number of ovules per carpel (11).



Harder, LD and MA Aizen. The interaction between pollination and post-pollination processes: opening the pistil's black box (en prep.).